Notes on the Penes of Damselflies (Odonata).

No. 2. The Close Relations inter se of the Hawaiian Agrionines.

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(Plates II and III.)

In my first paper* I discussed a genus (*Acanthagrion*) in which the various forms comprising it were so close in color and structure that many had been considered but varieties until a study of the penes showed each form to be a good species structurally, for the penes of the various species were remarkably different.

In this paper I wish to discuss a group, the Hawaiian Agrionines, in which just the opposite relation holds. In venation, color, size, and in the structure of the male claspers the Hawaiian Agrionines differ radically among themselves but the penes throughout are the same type.

This opportunity came recently while in Philadelphia when I had the privilege of examining the penes of nineteen species and varieties of Hawaiian Agrioninae. These were a series of specimens collected by Dr. R. C. L. Perkins, and given by him to Dr. P. P. Calvert. In all cases the determinations are those of Dr. Perkins and so probably agree with his published articles.† Lack of time prevented an examination of the specimens other than of the penes. As the number of specimens was small, in some cases there being only a single male or female, an attempt to study the specimens with a view to possible grouping would have been inadvisable as Dr. Perkins' own studies of this group show great ranges in variation in many of the species.

Ever since I first looked over the list of Hawaiian Odonata, I had been skeptical that twenty-four species of damselflies, the entire damselfly fauna of this isolated region, should be comprised in but two genera. Later, when I first glanced at the box of specimens on which this study is based, I felt certain that there were at least three genera and probably more.

* Ent. News, xxvii, 325-330, July, 1916.

† Fauna Hawaiiensis. Vol. I, p. clxxv.; Vol. II, pp. 63-77, and 693-696. R. C. L. Perkins.

The large red forms with the richly veined wings, appeared at first sight more than generically distinct from the various small dark species and my interest and surprise increased steadily as I examined species after species and found throughout almost identical penes. The study of the penes but confirms the opinions expressed by McLachlan* and Perkins that in spite of their diverse forms these Hawaiian species of Agrionines are so closely related *inter se* that it is questionable whether they should not remain as a single genus.

The figs. 1 to 38 show, better than I can describe, the uniformity in structure throughout this group. Probably it extends to those Hawaiian species in which the penis has not yet been examined.† This form of penis is peculiar among agrionine penes in that the third or apical segment is offset, or attached subapically to the second segment. The apical lobe has an apical, sagittal cleft, which in all but three species is at least half the length of the lobe in depth. All have the internal soft fold, but in all the terminal soft fold of segment two is lacking, unless it is homologous with that part of the apex of segment two which lies beyond the insertion of segment three. All degrees of spininess exist from no spines to a complete row along each side of the shaft.

The following classification is that of Perkins‡ and is based on the male appendages as the most constant character:—

Group 1. *xanthomelas, pacificum, nigrohamatum.*
Group 2. *oresitrophum, orobates, leptodemas, calliphya.*
Group 3. *koelense, asteliae, amaurodytum, eudytum, adytum.*
Group 4. *nesiotes.*
Group 5. *oahuense.*
Group 6. *deceptor, vagabundum, kauaiense, molokaiense, jugorum.*
Group 7. *oceanicum, blackburni, heterogamias.*

This does not include *calverti* or *williamsoni* the relationships of which species Perkins does not indicate.

* Ann. and Mag. Nat. Hist. (5), Vol. 12, p. 240.

† While studying the collection in the Museum of Comparative Zoology, Cambridge, Mass., I was able to examine *molokaiense* and the *fallax* and *waianacanum* varieties of *amaurodytum*. These all have the typical form of penis for this group.

‡ Fauna Hawaiiensis, Vol. II, p. 694.

In this paper I have used *Megalagrion* for these Hawaiian forms. The genus *Megalagrion* was established by McLachlan* for *blackburni* and *oceanicum,* with *blackburni* the type of the genus. Perkins later described *heterogamias* and considered it a close relative of these. He also pointed out that certain individuals of species in Group 6, especially of *kauaicnse,* showed the venational characters of *Megalagrion,* thus preventing the use of this generic name to set off these three with the richly veined wings from the other Hawaiian forms. Perkins placed the entire group in the old genus *Agrion,* now *Coenagrion.* Studies of the penes in these forms show that the genus *Coenagrion* can probably be broken up and that these Hawaiian species are a compact group quite distinct from the other groups. As *Megalagrion* has been used for some of these Hawaiian species, it will then become applicable to the entire series of Hawaiian Agrionines as I have used it.

I had hoped that the penes more than the other characters might give some clue to the relationship and probable origin of this group. The penes do show that these Hawaiian Agrionines in spite of the great range in their appearance and structure are a compact group and undoubtedly have been derived from some single ancient immigrant that had strayed into the islands. It lines the Odonata up with what is already known about the birds (Drepanidae), the land snails (Achatinellidae) and those orders of insects in which there are large endemic genera with apparently diverse but really closely related species. These strange groups have probably in each case been derived from some single ancestor which has strayed into the islands in the remote past.

More difficult is the origin and probable relationship of this ancestral Agrionine. A study of the penes in the species listed by Kirby as *Coenagrion* shows that the extra-Hawaiian forms fall into at least two groups, the group of which *puella* is the type (see figs. 39, 46-49) and the group of which *lindenii* is the type (see figs. 40-45). As *lindenii* has been given generic rank by Navas† as *Cercion lindenii,* probably *Cercion* can be

*Ann. and Mag. Nat. Hist. (5), Vol. 12, p. 237.
†Broteria 6, p. 55, 1907.

applied to the other three species figured as having penes similar to that of *lindenii*. I have so used it, though I should have compared these species in other characters had I had time. A good series of intermediate forms exists in the genus *Coenagrion* between the *puella* penis and such penes as are shown in figs. 46-49.

Of the two groups represented by *lindenii* and *puella* respectively, the penes would seem to indicate relationship of the Hawaiian Megalagrions with *Cercion* rather than with *Coenagrion* of the *puella* group. This agrees with McLachlan's observation* that the Hawaiian forms seemed more like *lindenii* than any of the other Eurasian species. As the American Coenagrions have penes which are aberrant forms of the *puella* type, this agrees with what is thought concerning the origin of the other peculiar Hawaiian genera: that these are not North American in origin.

My first paper showed that too much dependence cannot be put on penile characters alone, nevertheless a study of these in this case has thrown an interesting side light on this Hawaiian problem.

EXPLANATION OF PLATES II AND III.

Drawings of the penes of *Megalagrion, Cercion* and *Coenagrion*, being ventral and lateral views of the last two segments.

Figs. 1-2. *Megalagrion pacificum* (McLachlan). Northwest Koolau Range, Oahu, Hawaiian Islands; 1500 ft. elevation. April, 1901. R. C. L. Perkins coll.

Figs. 3-4. *Megalagrion xanthomelas* (Selys). Honolulu, Oahu, Hawaiian Islands. Nov., 1900. R. C. L. Perkins coll.

Figs. 5-6. *Megalagrion leptodemas* (Perkins). Northwest Koolau Range, Oahu, Hawaiian Islands; 1800 ft. elevation. April, 1901. R. C. L. Perkins coll.

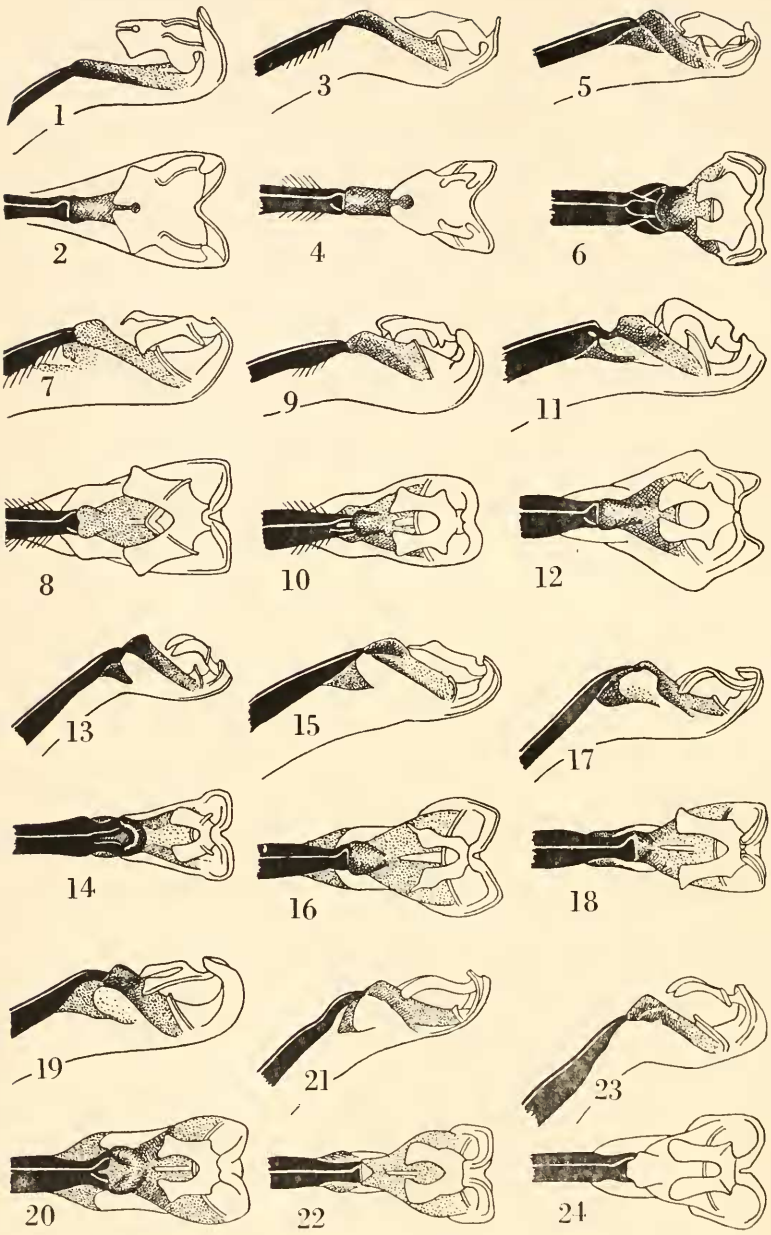
Figs. 7-8. *Megalagrion amaurodytum* var. *peles* (Perkins). Hawaii, Hawaiian Islands, 1901. Koebele coll.

Figs. 9-10. *Megalagrion calliphya* (McLachlan). Iao Valley, Maui, Hawaiian Islands. 1902. R. C. L. Perkins coll.

Figs. 11-12. *Megalagrion calliphya* var. *microdemas* Kilauea, Hawaii, Hawaiian Islands. July, 1903. R. C. L. Perkins coll.

Figs. 13-14. *Megalagrion eudytum* (Perkins). Lihue, Kauai, Hawaiian Islands; 1000 + ft. elevation. R. C. L. Perkins coll.

* Ann. and Mag. Nat. Hist. (5), Vol. 12, p. 240.



PENES OF HAWAIIAN AGRIONINAE.—KENNEDY.